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REMARKS/ARGUMENTS

Claims 1-36 were pending of which claims 1-22 were withdrawn and claims 23-36 were rejected. Claims 1-22 have been cancelled. Claims 23, 24, 25, 28, 29, 31, 33 and 36 have been amended and claims 37-39 have been added. Applicant requests reconsideration.

Amendments to claims 23 and 33 are discussed below. Amendments to claims 24, 25, 28, 29, 31, and 36 are for the sake of consistency with the claims from which they depend. New claims 37-39 are supported in the present application at, e.g., the paragraphs beginning on page 2, line 13 and page 8, line 27. Thus, no new matter is added.

Claim Rejections – 35 U.S.C. §102

Claims 23, 24, and 33 were rejected under 35 U.S.C. §102(e) as being anticipated by Nikoonahad et al. (7,009,704) ("Nikoonahad"). Claims 33 and 34 were rejected under 35 U.S.C. §102(e) as being anticipated by Raymond (6,856,408) ("Raymond"). Claims 23-33, 35, and 36 were rejected under 35 U.S.C. §102(e) as being anticipated by Mieher et al. (2004/0169861) ("Mieher"). Claims 23 and 24 were rejected under 35 U.S.C. §102(e) as being anticipated by Stirton (6,458,605) ("Stirton"). Reconsideration is respectfully requested.

In the Response to Arguments, the Examiner attempts to clarify the rejections. Applicant respectfully maintains that the cited references do not teach or suggest all of the claimed features.

Both independent claims 23 and 33 recite "determining a measurement of an overlay error ... and correcting the determined measurement of the overlay error for effects of the local process variations created during processing of the overlay pattern". The amendment makes explicit what was already implicit in the claim, i.e., that the measurement of the overlay error is what is determined and corrected, as opposed to the physical misalignment between the bottom and top diffraction gratings. For example, claims 23 and 33 recite "correcting the determined measurement of the overlay error ... using the detected radiation from at least one pair of the measurement locations from the overlay pattern." If it was the physical misalignment between the bottom and top diffraction gratings that is to be corrected, the "determined measurement of the overlay error" would be used, as opposed "the detected radiation". Thus, it is clear that the claim recites that it is the overlay error measurement that is corrected; not the physical misalignment between layers on the sample.

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Applicant points out that the recited "correcting the determined measurement of the overlay error" is different than using the determined overlay error in a feed back loop to correct the processing of wafers to control overlay errors on subsequently processed wafers.

"Correcting the determined measurement of the overlay error" is directed at improving the measurement of the overlay error, whereas using the overlay error measurement in a feed back loop during processing is not correcting the measurement but is attempting to reduce or eliminate overlay errors during processing. Additionally, using the overlay error measurement in a feed back loop during processing does not "us[e] the detected radiation from at least one pair of the measurement locations from the overlay pattern" as recited in the claims.

Moreover, the claim recites "determining a measurement of an overlay error ... and correcting the determined measurement of the overlay error", i.e., the same overlay error measurement that was determined is being corrected. When an overlay error measurement is used to control subsequent processing of wafers, the processing error that is being corrected is not the "determined measurement".

Additionally, independent claims 23 and 33 have been amended to recite "wherein at least two measurement locations in the overlay pattern differ from each other at least partially due to local process variations created during processing of the overlay pattern". Thus, the "local process variations" are variations that occur between measurement locations in the same overlay pattern, as opposed to variations that may occur between separate overlay patterns. Support for this amendment to claims 23 and 33 may be found, e.g., in Fig. 4 and the accompanying text.

Applicant submits that none of the references alone or in combination disclose the claimed features. Applicant will address each reference separately.

Nikoonahad

The Examiner stated that

Nikoonahad discloses correcting (corresponding to "correct any errors" in col. 15, line 58) the determined overlay error (corresponding to "Overlay errors... are then measured" in col. 15, lines 53-55 then corrected since Nikoohahad can correct any errors such as overlay errors) for effects (that cause "pitches of the... gratings [to] be different in the two-dimensional image" in

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col. 11, lines 61-65) of local process variations (corresponding to different elevations as represented in fig. 9).

Applicant respectfully disagrees with the Examiner's interpretation of Nikoonahad. For example, the Examiner cites to col. 15, line 58 as disclosing "correct[]" "any errors". Nikoonahad at col. 15, line 53-59, however, is discussing feeding back a measured overlay error to a stepper, "where such information can be used to alter the lithographic process in stepper 350 to correct any errors". Thus, as discuss above, Nikoonahad discloses a feedback mechanism to control overlay errors in subsequent processing, not correcting "the determined measurement of the overlay error ... using the detected radiation from at least one pair of the measurement locations from the overlay pattern."

Additionally, the Examiner cites to col. 11, lines 61-65 as an example of local process variations. Applicant points out, however, that Nikoonahad is disclosing in Fig. 9 and col. 11, lines 61-65 only that the pitches of the gratings may be different in the two-dimensional image of the gratings "[s]ince the pair of gratings 132, 134 are at an elevation different from that of pair of gratings 136, 138." Thus, Nikoonahad is not referring to local process variations, i.e., differences in the measurement locations in the overlay pattern, but is simply referring to an effect of perspective on the two dimensional image of the overlay pattern, where a closer object appears larger than a farther object and accordingly, the pitch of the farther grating may appear different than the pitch of the closer grating.

Nikoonahad does not teach or suggest "correcting the determined measurement of the overlay error for effects of the local process variations created during processing of the overlay pattern using the detected radiation from at least one pair of the measurement locations from the overlay pattern."

Raymond

The Examiner stated that

Raymond discloses correcting (via figures 16 and 17 that show more information about offset -50 nm relative to fig. 15 that cannot distinguish an offset of +50nm from -50nm as shown by the plots in fig. 15) the determined overlay error (in fig. 15 as offset -50nm) for effects of local process variations (corresponding to "thickness of the grating" in col. 6, lines 54 as shown in the top grating of fig. 16 for an offset=50 nm that shows different grating thicknesses for the top grating).

Applicant respectfully disagrees with the Examiner's interpretation of Raymond. Figs. 16 and 17 illustrate signatures achieved using "a conical scan" as opposed to a

"conventional scan" illustrated in Fig. 15. Col. 11, lines 50-56. Thus, Figs. 16 and 17 illustrate the superior performance of a conical scan relative to the conventional scan shown in Fig. 15. There is, however, no disclosure of correcting the determined measurement of the overlay error for local process variations.

The Examiner cites to the mention of "thickness of the grating" at col. 6, line 54 as a local process variation" that Figs. 16 and 17 correct relative to Fig. 15. Figs. 16 and 17 simply illustrate superior performance of a conical scan relative to the conventional scan shown in Fig. 15 in that the "conical scans provide unique signatures with respect to left and right shifts." Col. 11, lines 60-64. Figs. 16 and 17 do not correct for local process variations.

The Examiner states that local process variations "correspond[] to 'thickness of the grating' in col. 6, lines 54 as shown in the top grating of fig. 16 for an offset=50 nm that shows different grating thicknesses for the top grating." The Examiner appears confused between "offset" which is the left or right shift of the top grating relative to the bottom grating, and the grating thickness which is the height of the grating. Contrary to the Examiner's statement, Fig. 16 shows various offsets, i.e., shifts between the top and bottom gratings, but does not show a change of thickness.

Raymond does not teach or suggest "correcting the determined measurement of the overlay error for effects of the local process variations created during processing of the overlay pattern using the detected radiation from at least one pair of the measurement locations from the overlay pattern."

Stirton

The Examiner stated that

Stirton discloses correcting the determined overlay error (corresponding to a "reduction in the overlay error" in col. 11, line 13) for effects of local process variations (corresponding to "different semiconductor manufacturing process conditions" in col. 11, lines 3, 4).

Applicant respectfully disagrees with the Examiner's interpretation of Stirton. As discuss above, Stirton discloses a feedback mechanism to control overlay errors in subsequent processing, not correcting "the determined measurement of the overlay error ... using the detected radiation from at least one pair of the measurement locations from the overlay pattern." For example, Stirton notes at col. 11, lines 7-9 that "the controller may more accurately evaluate the conditions in which a subsequent semiconductor wafer lot in the

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control thread will be processed.” Stirton further states “[t]he implementation of the control scheme described by the present invention can lead to a reduction in the overlay error.” Thus, Stirton is using measured overlay error to control the processing of subsequent semiconductor wafer lots to reduce overlay error in those lots.

Stirton does not teach or suggest “correcting the determined measurement of the overlay error for effects of the local process variations created during processing of the overlay pattern using the detected radiation from at least one pair of the measurement locations from the overlay pattern.”

Mieher

The Examiner stated that

Mieher discloses correcting (via “separate[ing]” in paragraph [0133], line 6 to “improve the measurement precision” in [0133], last sentence) the determined overlay error (or “overlay” in [0133], line 7) for effects (“effects” in [0133], line 6) of local process variations (where said effects correspond to “film effects” in [0133] 7 which correspond to “film thickness variation” in [0006], line 8 that contribute to the overlay measurement, and thus has to be separated from the determined overlay error with film effects).

Applicant respectfully disagrees with the Examiner’s interpretation of Mieher. Paragraph [0133] of Mieher is related to using multiple measurement systems and in particular using a simultaneous ellipsometry and reflectometry. See, paragraph [0133], last sentence, and paragraph [0129]. Neither paragraph [0133] nor paragraph [0006] discuss local process variations in the form of “film thickness variation”. For example, paragraph [0006] discusses disadvantages of different approaches to determining overlay and notes that “[f]or example, a relatively large number of parameters must be included in the profile, overlay, and film modeling to accurately determine the overlay... If film thicknesses variation is included in the model, the number of parameters increases correspondingly.” Thus, paragraph [0006] discusses the increase in the number of parameters when film thickness variation must be modeled.

Applicant notes that Mieher also discloses at, e.g., paragraph [0090] that “scatterometry systems may take measurements at multiple sites sequentially in order ... to eliminate effects due to variations in other sample parameters, such as film thickness.” Applicant points out that Mieher is not discussing local process variations, i.e., differences in

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measurement locations within the same overlay pattern", but is instead discussing variations between separate overlay patterns across that wafer.

Thus, Mieher does not disclose or suggest correcting "the determined measurement of the overlay error for effects of the local process variations" that occur within a single overlay pattern as recited in claims 23 and 33. Moreover, Mieher does not teach or suggest "correcting the determined measurement of the overlay error ... using the detected radiation from at least one pair of the measurement locations from the overlay pattern."

Thus, Applicants respectfully submit that claims 23 and 33 are patentable over Nikoonahad, Raymond, Mieher and Stirton. Reconsideration and withdrawal of this rejection is respectfully requested. Claims 24-32 depend from claim 23 and claims 34-36 depend from claim 33, and are, therefore, likewise patentable for at least the same reasons. For the above reasons, Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 378-7777 ext 112.

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Respectfully submitted,



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